Alternative & Augmentative Communication (AAC)/ Cortical Visual Impairment (CVI) Matrix:

Student-Centered Guidelines for AAC & Expressive Communication Development

An instrument for professionals and families to balance the results of Communication Matrix assessment (Rowland, 1996; Rev. 2004) with CVI Range assessment (Roman, 2007; Rev. 2018)

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This instrument was developed using content from:

Roman, C. (2018) Cortical visual impairment: An approach to assessment and intervention (2nd Ed.). New York, NY: AFB Press.

Rowland, C. (1996; Rev. 2004). Communication matrix. Portland, OR: Design to Learn. http://www.communicationmatrix.org

WHO IS THIS INSTRUMENT DESIGNED FOR & WHAT ARE THE PREREQUISITES FOR USING IT TO SUPPORT MY STUDENT/CHILD?

This instrument is designed for educational team members of various roles, and family members of students with cortical visual impairment (CVI) and complex communication needs. Use of the instrument requires background knowledge of the CVI Range approach to assessment and intervention (Roman, 2007; Rev., 2018), and the Communication Matrix approach to assessment of expressive communication development from pre-intentional behavior to language across four primary functions of communication (Rowland, 1996; Rev., 2004). *In order to effectively use this instrument, the student should have a recent CVI Range assessment and a recent Communication Matrix assessment, as the results of both assessments are critical to guide appropriate interventions.*

Before you begin, explore these resources for background information and context:

Cortical Visual Impairment

- Roman, C. (2018) Cortical visual impairment: An approach to assessment and intervention (2nd Ed.). New York, NY: AFB Press.
- CVI Fact Sheet (NYDBC): http://bit.ly/CVIFACTSHEET
- Online courses available through Perkins School for the Blind eLearning: https://www.perkinselearning.org/earn-credits/online-class
- Pediatric Cortical Visual Impairment Society (PCVIS) website: https://pcvis.vision/

Communication Matrix

- Communication Matrix official website - Access the assessment (free online version), community of practice and discussion forums, sample assessments and reports, research and data: https://communicationmatrix.org/
- Communication Matrix Training- A 3-part webinar series presented by Kathee Scoggin
    - Part 1: https://www.youtube.com/watch?v=EuufdwrD4wg&t=2128s
    - Part 2: https://www.youtube.com/watch?v=WYWpHGzZyVk
    - Part 3: https://www.youtube.com/watch?v=NblRn-Q7sIQ

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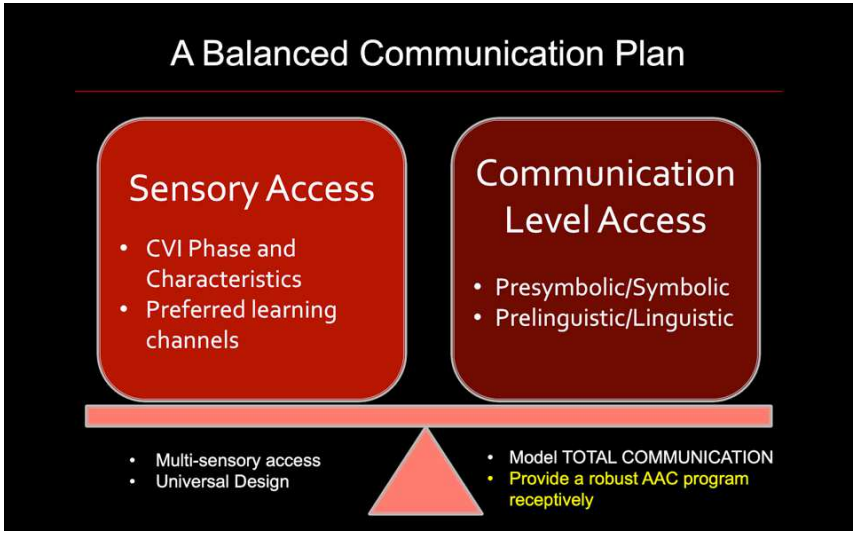


Expressive communication modalities for students with CVI should be selected and adapted to reflect a balance between the student's conceptual and expressive language development (Communication Matrix), and sensory access/goals appropriate to each Phase (CVI Range). ***We want to create a match between what is appropriate visually, and what is appropriate for the child's current expressive communication and concept development.*** This is a "balanced" expressive communication plan.

Examples of **mismatches** in expressive communication levels and sensory access needs:

- Communication that is visually inaccessible: An eye gaze system for a student in Phase I
- Communication that is visually accessible, but inappropriate in terms of communication development (current expressive levels): A complex 2-D high tech AAC system for a student in Phase III, but the child is currently a pre-symbolic communicator

TIP: Always presume competence and that the child with complex communication needs can receptively understand more than he/she is able to express (if provided in a sensory-accessible format, whether through signed/ spoken language).

Signed language (as referenced throughout this document) refers to the modality of presenting language visually/tactually on the hands and includes various language variations, such as American Sign Language, Pidgin Signed English, Signed Exact English, etc. Other systematic means of tactile input should also be considered, such as ProTactile, haptics, etc. It is important to model abstract modes of communication and provide access and exposure to language that consists of a robust receptive communication program, while scaffolding expressive communication development with concrete modes at the student's current expressive levels.

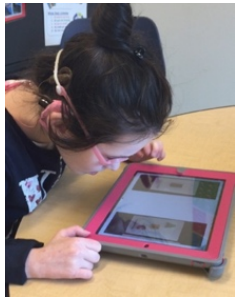
TIP: Children with congenital visual impairments including CVI have reduced access to incidental information and observational learning.

Reduced access to incidental learning by observing others and the environment has an overarching impact on development across domains. Children with congenital visual impairments and additional multiple disabilities often develop unconventional forms of expressive communication as a result of this lack of observation of what "typical" communication looks like. For children with dual sensory loss and/or congenital visual impairment and multiple disabilities, unique interventions are often required to support the milestone of symbolism (Bruce, 2005; Brady & Bashinski, 2008). The role of vision in early childhood development cannot be underplayed, and the impact on other areas of development should not be misunderstood as cognitive impairment or learning disability.

TIP: It is important to develop communication systems that can grow with the student as he/she makes progress both visually (on the CVI Range) and in expressive communication (on the Communication Matrix).

For example, a tangible symbol system for a concrete communicator in Phase I may develop into a photo symbol system for that concrete communicator in late Phase II, and into a language-level high tech AAC device when the student is at the abstract or language level of expressive communication, and in late Phase II/Phase III.

Concrete 3-D tangible symbols



Backlit device, 2-D versions of familiar symbols, low-tech version of system

Transition to expressive language, high tech AAC with sight words (bubbled)
Used courtesy of Lynn Elko:
http://seecvispeakaac.com/

II. Description of AAC/CVI Matrix

The AAC/CVI Matrix is a chart that supports you in matching a student's CVI Range score (by Phase) with their current expressive language levels (based on the Communication Matrix) in order to determine a course of action for selecting and adapting an accessible communication system. Points included in the chart are considerations based on the needs in each area, not strict guidelines. CVI intervention is guided by Phase, but there is no "one size fits all" approach. Visual adaptations are unique to each student's needs, based on the impact of CVI Characteristics on visual functioning. Expressive communication intervention is guided by the student's current levels of expressive/symbolic communication. It is important to consider that language for children with complex communication needs does not always develop in a linear fashion following typical development. Students may have skills that are scattered across different levels and functions of communication, and it may be relevant to consider goals and the use of AAC across more than one level of communication. For example, a student may use unconventional communication behaviors to refuse, while utilizing tangible symbols to request, and may have an emerging use of individual signs or spoken words for social communication.

Description of unique terms are provided in the Appendix section along with additional resources.

A. Setting the Stage

TIP: Receptively model accessible language (sign, speech, AAC voice output, etc.) for ALL students consistently, while scaffolding expressive communication development in appropriate modalities.

"Augmentative and Alternative Communication (AAC) includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas. We all use AAC when we make facial expressions or gestures, use symbols or pictures, or write." (www.asha.org) Children with CVI often have difficulty managing sensory input from multiple modalities at the same time. Therefore, it is critical that communication partners use a systematic, deliberate approach to balancing sensory input while providing appropriate and accessible communication input and modeling.

TIP: Pair the intervention considerations listed in this document for each Phase with the suggestions for intervention from the Vision, Language, Learning, Communication (VLLC) Framework

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The VLLC Framework (Roman & Blackstone, 2019) also includes "Sample Scripts," which offer examples of how a communication partner may model communication and visual input appropriate to learners with CVI. These scripts include considerations for providing receptive input, modeling communication and language, and providing appropriate sensory balance. *See VI. Additional Resources for more information about the VLLC Framework.*

B. Modalities of AAC:

Table 1 matches the levels of expressive communication provided in the Communication Matrix (Rowland, 1996; Rev. 2004) with the CVI/AAC Matrix's categories of expressive communicators. These categories are used below in section IV. Using the AAC/CVI Matrix.

Table 1

Levels of Expressive Communication Development (Communication Matrix [Rowland, 1996; Rev., 2004])	CVI/AAC Matrix Categories of Expressive Communicators
Pre-Intentional behaviors- *spontaneous, apparently reactive behaviors to environmental stimuli; partner must perceive the purpose/meaning*	**Emerging Pre-symbolic Communicators-** *individual does not yet have an understanding of symbols, communicates through behaviors/other pre-symbolic means, message must be interpreted by a responsive communication partner who knows the child well*
Intentional behavior- *purposeful/goal-directed behavior but not yet directed at someone or intended to communicate a message to others; partner must interpret the meaning of the action*	
Unconventional communication- *actions/unconventional gestures directed at a communication partner with the intent to send a message; often developed through repeated response/reinforcement by the communication partner during shared experiences*	
Conventional communication- *pre-linguistic movements that are part of a learned, shared system and have a meaning that is understood within a society or culture (e.g. pointing, waving)*	**Concrete Symbolic Communicators-** *utilizes conventional gestures, tangible symbols, photo and/or line drawings for expressive communication*
Concrete Symbols- *items that are both physically tangible (objects, photos, drawings) and conceptually tangible to the individual user; these serve as a bridge between pre-symbolic and symbolic communication*	
Abstract Symbols- *speech, signs, printed words; used as single-word utterances, not connected language*	**Abstract Symbolic Communicators-** *utilizes abstract symbols and/or words consistently and effectively to communicate*
Language- *abstract symbols used in two or more word combinations according to grammatical rules.*	

III. CVI Phases: General Considerations

NOTE: CVI interventions are unique to each individual based on the impact of the CVI Characteristics on functional vision (determined by CVI Range functional vision assessment [Roman, 2007; Rev. 2018]). Intervention is not a "one size fits all" approach.

Table 2 provides general intervention considerations for each Phase that should be paired with the specific considerations detailed in the AAC/CVI Matrix below. Select the considerations that are most relevant to your child/student in the appropriate Phase.

Table 2

Phase I GOAL: Building visual behavior	
Key points	• All of the Characteristics impact visual functioning. • Looking is a goal in and of itself. Children in Phase I cannot look while doing, listening, or receiving information through tactile sign language. • Receptive language should be presented tactilely/auditorily (objects, tactile signs, spoken language).
Color	• Use favorite colors, only 1 or 2 colors on a target • Color is always the first characteristic used for visual discrimination in any phase, and should be used deliberately (e.g., spacing out symbols of the same color).
Movement	• Use reflective materials or move the visual target (object/symbol) to elicit or sustain visual attention
Latency	• Allow sufficient wait time for learner to respond after target is presented
Visual Field Preference	• Present all AAC material's in the learner's preferred visual field(s)
Complexity	• Minimize background noise, visual clutter, distracting bright primary sources of light and movement (ceiling fans, windows); Present targets one at a time against a plain background (black/white) • The student's ability to visually fixate on and locate symbols on the array of an AAC modality will also be impacted by multisensory complexity. This includes internal and external factors (environmental considerations, how the student is feeling, how the student is positioned, etc.). While still prioritizing visual interventions, motor memory may be used to access AAC in any Phase.
Light	• Illuminate visual targets with a flashlight, from behind and/or present items on a light-box/backlit device; Position student away from primary light sources
Distance	• Present all AAC at near distance (usually less than 18") from learner
Novelty	• Utilize objects that are familiar to the learner; Novel objects should consider other CVI characteristics (color, complexity, etc.)

Visually Guided Reach	• Utilize hand under hand support to assist learner in accessing materials tactilely

Phase II: ***GOAL: Integrate vision and function***	
Key points	• The child is able to use vision in the context of activities and routines **if the appropriate adaptations are in place.** • Learners in Phase II are able to attend visually in less controlled and more natural environments with increased sensory and visual complexity simultaneously in the background. The degree of environmental control needed for individual learners (ex: novelty and complexity) will be determined by the CVI Range Assessment, Rating 2.
Early Phase II	• Anything presented in 2-D should be presented against a backlit surface, with reduced complexity of array, and/or with movement. • If child is not able to elicit/sustain visual attention due to internal/external impeding factors (environment, sensory regulation, etc.), reduce visual demands and present items tactilely for recognition and comprehension. • Do not expect visual fixation on 2-D symbols in early Phase II (until the student demonstrates eye-to-object contact). • For learners who do not have access to 2-D (early Phase II), provide exposure to 2-D in aided AAC modes with modeled use. Support with descriptions (describe, point to, or highlight salient features).
Late Phase II	• Backlighting will help to extend visual attention and reduce visual fatigue. • Students in late Phase II have emerging access to 2-D but may not have the visual vocabulary or the conceptual understanding of 2-D materials without additional salient feature instruction and development of comparative thought. • Minimize complexity of array and target on 2-D targets (for any form of AAC). • Develop AAC vocabulary with familiar items and words, pair with adapted 2-D images such as photos of real objects.
Color	• Use preferred color(s) to highlight major/salient features of devices and symbols; Use occluders or color frames to outline targets/symbols on partner-assisted scanning displays • Color is always the first characteristic used for visual discrimination in any phase, and should be used deliberately (e.g., spacing out symbols of the same color)

Movement	• Use reflective materials such as gold or red shiny tape/paper to line or cover AAC mode (a symbol or finished box) Use movement at a distance to attend; use Phase I strategies when learner is fatigued
Latency	• Allow processing time for more complex or novel AAC targets
Visual Field Preference	• Learner may now be able to view AAC mode in central, upper fields (at midline). Consider presenting novel or complex materials in original preferred field.
Complexity	• It may be difficult for the learner to visually access AAC when performing other tasks or in movement (O&M) routines, or when positioned/seated without necessary trunk/head support • Increase the number of items unmasked on an AAC display to the degree that the learner can access (e.g., may be up to 4 at a time, with adequate spacing) • If necessary to support tactile access (visually guided reach), outline visual AAC targets with (colored) tactile components (keyguards, tactile grids) • Use black background for more complex/novel targets or environments, use increased complexity of background appropriate to Range results (and What's the Complexity Framework [Tietjen, 2018]) • Support attention to faces by considering additional sensory/visual complexity (while partner is speaking vs silent, moving vs still) • The student's ability to visually fixate on and locate symbols on the array of an AAC modality will also be impacted by multisensory complexity. This includes internal and external factors (environmental considerations, how the student is feeling, how the student is positioned, etc.). While still prioritizing visual interventions, motor memory may be used to access AAC in any Phase.
Light	• Support visual attention to AAC modes with backlighting (tablet or other backlit surface)
Distance	• Learner may be able to attend at increased distance (2-3, 4-6, 10') depending on complexity
Novelty	• Develop AAC vocabulary with familiar items and words, pair with familiar objects
Visually Guided Reach	• Allow the learner to look-look away-touch for more complex targets

Phase III: ***GOAL: Refinement of the CVI Characteristics***	
Key points	• Children in Phase III may demonstrate visual curiosity. • Instruction of salient visual features and use of comparative language remains critical. • Visual imitation begins to be possible in Phase III, which allows for access to visual modeling of conventional gestures, and visual modeling of the use of AAC systems and devices.
Color	• Increased number of colors on a display or target (6-8) is accessible; Use color to outline (bubble) words and highlight salient features of complex 2-D visual information on symbols, images, books. • Color is always the first characteristic used for visual discrimination in any phase, and should be used deliberately (e.g., highlighting salient features, spacing out symbols of the same color rather than placing symbols of the same color directly next to each other [as in a typical Fitzgerald Key array]).
Movement	• Movement is not necessary to elicit or maintain visual attention at near, but may still be an environmental distractor.
Latency	• Allow processing time for more complex or novel AAC targets or in more complex environments. Individuals in Phase III may experience sensory overstimulation following prolonged periods of visual and multisensory input, resulting in increased latency.
Visual Field Preference	• Lower field can still be difficult in Phase III
Complexity	• Complexity of array (the number of symbols shown on a display) will continue to be a challenge in Phase III. The student may have an increased ability to manage complexity of array (number of cells visible on displays) and target on 2-D materials and on background patterns. Consider complexity of the background and patterns on communication partners' clothing as potential impeding factors to distance viewing. • The student's ability to visually fixate on and locate symbols on the array of an AAC modality will also be impacted by multisensory complexity. This includes internal and external factors (environmental considerations, how the student is feeling, how the student is positioned, etc.). While still prioritizing visual interventions, motor memory may be used to access AAC in any Phase.
Light	• Use back-lighting to support access to 2-D and complex targets (iPad/tablet, high-tech AAC display)
Distance	• Learner may be able to attend at increased distance (10'+) depending on complexity
Novelty	• Expand on the development of AAC vocabulary by adding new items and words in combination with salient feature instruction and the use of comparative language.
Visually Guided Reach	• Visually guided reach may be more difficult given fatigue, overstimulation, and/or increased multisensory complexity/complexity of the array.

IV. Using the AAC/CVI Matrix - Complete steps A & B

A. The child/student's current intersection of CVI Range score and Communication Matrix/expressive communication level is: *(Mark an X in the appropriate box)*

Table 3

	Emerging Pre-symbolic Communicator (does not yet have an understanding of symbols, communicates through behaviors/other pre-symbolic means)	**Concrete Symbolic Communicator** (utilizes tangible symbols, photo and line drawings for expressive communication)	**Abstract Symbolic Communicator** (utilizes abstract symbols and/or words consistently and effectively to communicate)
Phase I			
Early Phase II			
Late Phase II			
Phase III			

B. Below you will find extensive possible considerations for developing and adapting AAC appropriate to your student's CVI Range results organized by Phase, and current level of expressive communication (determined by Communication Matrix results).

Based on your response in Table 3 above, locate the appropriate CVI Phase and current level of expressive communication below and check boxes for any considerations that are relevant to your child/student.

PHASE I: (Approximate score of 0-3 on the CVI Range)

For Emerging Pre-symbolic Communicators: (communicates through behaviors and other pre-symbolic means)	**For Concrete Symbolic Communicators:** (communicates through tangible symbols, photo and/or line drawings)	**For Abstract Symbolic Communicators:** (communicates through abstract symbols and/or words)
☐ **Touch cues, tactile name cues:** Do not expect visual attention while in tactile contact with the student ☐ **Real objects in an anticipation calendar:** Object cues should be visually simple (reduced complexity of target and array [presented against a black or white background]); should include whole or partial highly familiar objects ☐ NO MINIATURES ☐ Present tactilely for object recognition/identification ☐ Do not expect visual fixation on objects, but still make the visual adaptations appropriate to Phase I (for example, illuminate object with flashlight or place on lightbox to establish visual regard) ☐ Finished box can be a bright, preferred color or lined with shiny/reflective mylar material	☐ **Touch cues, tactile name cues:** Same considerations as for Emerging Pre-Symbolic ☐ **Tangible symbols on communication system level:** (objects, photos, picture symbols mounted on cardboard or plastic): should be visually simple (reduced complexity of target and array [presented against a black or white background]); should include whole or partial highly familiar objects ☐ **Choice boards, Calendar systems/sequence boards**: Limit complexity of the array, allow for space (3-4" minimum) between symbols ☐ Finished box can be a bright, preferred color or lined with shiny/reflective mylar material ☐ May illuminate with flashlight or use movement to elicit brief visual attention to tangible symbols (but do not expect visual	☐ **Voice output devices** (low, medium, high-tech): accessed tactilely and/or auditorily ☐ *Keyguards:* use tactile keyguards to help teach tactile navigation of devices ☐ *For motor memory access* of high-tech devices with complex arrays, eliminate unnecessary visual components to reduce visual overstimulation ☐ Use auditory or partner-assisted scanning ☐ Use bright single-color switches to access selections. ☐ **Literacy modes** (writing for expression): ☐ Example: Touch-typing with screen reader, use of alternative pencil, etc. ☐ Braille is not an appropriate literacy modality for a learner with CVI in the absence of additional significant or degenerative ocular visual impairments.

☐ **Hand-under-hand:** Increase comfort with hand-under-hand interactions for sensory play, exploration, and joint attention ☐ **Model conventional gestures** with hand-under-hand ☐ **Voice output devices** for communication partner modeling of the initiation of specific concrete interactions	fixation or visual discrimination of symbols) ☐ Consistent use of concrete tangible symbols for both receptive and expressive communication (ex: choice making): The symbols should be tactilely and visually distinct. At this stage the symbols will be primarily accessed tactilely by the student. ☐ **Voice output devices** for requests/comments that can be consistently reinforced o May include **single or multicell voice output device with tangible symbols** ☐ Use hand-under-hand interaction when necessary to access tangible symbols and objects; pair with language	

Signed languages (tactile ASL, PSE, SEE, etc.) ☐ Signed language will only be accessible tactually ☐ Emphasize motor memory for production of signs	**Tactile Input Systems** (Pro-Tactile, haptics, etc.) ☐ Consider the impact of tactile input on multisensory complexity

PHASE II (EARLY): (Approximate Score of 3-5 on the CVI Range)

For Emerging Pre-symbolic Communicators: (communicates through behaviors and other pre-symbolic means)	**For Concrete Symbolic Communicators:** (communicates through tangible symbols, photo and/or line drawings)	**For Abstract Symbolic Communicators:** (communicates through abstract symbols and/or words)
☐ **Touch cues, tactile name cues:** Child may be able to establish visual attention (to an object or to the part of the body being touched) while in physical contact, given additional visual processing time ☐ For example, given a touch cue for "time to put on AFOs" (light touch on shin), and shown the AFO (presented in preferred visual field against a non-complex array, given movement and wait time), the child will shift gaze to establish brief visual regard to the AFO. ☐ **Real objects in an anticipation calendar** should be tactilely and visually distinct; Expect brief visual regard and emerging fixation on objects/cues separate from tactile exploration ☐ Visual components adapted based on student's CVI Range results: see general Early Phase II considerations above	☐ **Touch cues, tactile name cues:** Same considerations as for Emerging Pre-Symbolic ☐ **Tangible symbols on communication system level** (objects, object cues mounted on cardboard or plastic): Same visual considerations as in Phase I-Concrete, but the student in Early Phase II should be expected to visually regard and begin to fixate more consistently on the visual properties of symbols ☐ Highlight the larger components of AAC modalities and use preferred colors to anchor visual attention (e.g. red tape around the rim of a finished box, highlight the salient features of a tangible symbol or photo) ☐ **Considerations for 2-D:** In early Phase II, 2-D access is limited due to lack of eye-to-object contact and use of ventral stream processing; if using 2-D symbols for communication purposes, emphasize highly distinct features (bright saturated colors, consistent positioning, highly distinct shapes) and do not expect discrimination of details	☐ **Voice output devices** (low, medium, high-tech): ☐ Use familiar and **highly visually distinct** symbols (photos, line drawings, etc.), with reduced background complexity ☐ Do not expect the student to fixate on or visually locate symbols on the array; identification of and access to symbols will be based on pre-teaching and modeling those **distinct** symbols ☐ Use adequate spacing between symbols on a black background with no border is optimal; if the symbol is darker, highlight or outline with a bright color; reduce the array by masking unused cells ☐ Make symbols more distinct with bright saturated colors, reduced visual complexity, and ensuring that symbols look very different from each other

☐ Should include whole or partial highly familiar objects ☐ May illuminate object with flashlight or place on lightbox to elicit/sustain visual fixation ☐ Visually adapt finished box ☐ **Hand-under-hand:** Pause and allow processing time for the student to use vision simultaneous to hand-under-hand contact ☐ **Model conventional gestures** visually. The student may still benefit from some hand-under-hand [for example, for pointing gesture]. ☐ Reduce the complexity of background array (wear a black shirt, position the student away from/with back to complex backgrounds) ☐ **Voice output devices** for communication partner modeling of the initiation of specific concrete interactions: ☐ Use color, light, movement, and/or reduced complexity to elicit visual regard/fixation to device prior to child activating	☐ **Choice boards, Calendar systems/sequence boards**: Same considerations as Phase I-Concrete, but expect visual regard and emerging visual discrimination, recognition, identification of symbols ☐ **Finished box**: Same considerations as Phase I-Concrete, but expect visual regard to locate finished box; do not expect visually guided reach simultaneous to putting symbol in finished box ☐ **Voice output devices** for requests/comments that can be consistently reinforced ☐ May include single or multi-cell voice output device with tangible symbols/ visual adaptations ☐ iPad/tablet AAC with color highlighting of key buttons for identification ☐ **Hand-under-hand:** Student may still benefit from some hand-under-hand guidance to access tangible symbols and objects; pause and allow for processing time to look simultaneous to physical contact; continue to pair symbols with language	☐ Model use of device/access to symbols and/or provide partner-assisted scanning with manual color windows or occluders (same size as the outline of the symbol) ☐ *For motor memory access* of high-tech devices with complex arrays, eliminate unnecessary visual components to reduce visual overstimulation
Signed languages (tactile ASL, PSE, SEE, etc.) ☐ Signed language should still be presented primarily tactilely or visually at near (for receptive); visual regard of the communication partner's hands/face may increase incidentally as a result of improved visual functioning		**Tactile Input Systems** (Pro-Tactile, haptics, etc.) ☐ Consider the impact of tactile input on multisensory complexity

☐ Gain student's visual attention prior to presenting information ☐ Visual language should be presented separately from other visual tasks ☐ Present signs in student's preferred visual fields (generally at eye level) ☐ Reduced complexity of background is critical (including clothing of the signer) ☐ Allow for looking away when engaging in physical contact ☐ Modality switching (between visual/tactile or visual/auditory as appropriate) will likely be necessary due to visual fatigue or environmental complexity ☐ Slower pacing during visual presentation, isolation of signs with similar handshape, location, etc. for discrimination of details ☐ Tactile modeling/direct instruction for mirror imaging of signs and production of new vocabulary; Visual imitation does not occur until Phase III.	☐ Tactile input systems may allow the communication partner to provide additional language input without requiring the student to shift gaze from the visual task at hand.

PHASE II (LATE): (Approximate score of 5-7 on the CVI Range)

For Emerging Pre-symbolic Communicators: (communicates through behaviors and other pre-symbolic means)	**For Concrete Symbolic Communicators:** (communicates through tangible symbols, photo and/or line drawings)	**For Abstract Symbolic Communicators:** (communicates through abstract symbols and/or words)
☐ **Touch cues and tactile name cues**: ☐ Students in late Phase II may still benefit from touch cues and tactile name cues for concrete anticipation and for information during transitions ☐ Tactile cues should always be paired with a visual referent in late Phase II ☐ Continue to use appropriate wait time and scaffold sensory input to allow the student to process and shift regard/fixation from tactile/auditory to visual information ☐ **Presentation of real objects or object cues in an anticipation calendar** ☐ Present objects **visually** based on CVI Range results (with regard to color, complexity, movement, distance, visual fields) ☐ Support student to visually regard **finished box** and display at least	☐ **Touch cues, tactile name cues:** Same considerations as for Emerging Pre-Symbolic ☐ **Tangible symbols on communication system level** (objects, photos, picture symbols mounted on cardboard or plastic) ☐ Expect visual fixation on symbols (objects, photos, line drawings) with appropriate adaptations to complexity, color, light, movement, visual fields, latency ☐ **Considerations for 2-D:** Use photos of real objects/activities when possible; for abstract symbols, make sure they are as visually distinct as possible; Eliminate background complexity, photograph whole object (not part); Teach photo symbols in direct connection with the objects they refer to; Present 2-D icons with backlighting or illuminate with a flashlight ☐ Teach salient features of unique symbols separate from natural use in communication routines - use strategies for salient feature	☐ **Voice output devices** (low, medium, high-tech): ☐ Increased number of 2-D symbols in an array may be accessible, with continued use of spacing and reduced complexity as needed (see above considerations in early Phase II-Abstract Symbolic) ☐ Support (and expect) the student to fixate on and locate symbols on the array visually; identification of and access to symbols will be based on pre-teaching and use of salient features and comparative thought to recognize novel symbols ☐ Model use of device/access to new or more complex symbols and/or provide partner-assisted scanning with manual color windows or occluders (same size as the outline of the symbol) ☐ **Considerations for 2-D:** Same as late Phase II-Concrete Pre-Symbolic (see column to the left), with

emerging visually guided reach when handling symbols ☐ **Hand-under-hand** interaction and constant physical contact may still benefit the student in more complex/novel environments or with more complex/novel materials ☐ Consistently **model conventional gestures** visually with reduced background complexity, and in preferred visual fields ☐ **Voice output devices** for communication partner modeling of the initiation of specific concrete interactions ☐ Elicit (and expect) visual attention to voice output device prior to modeling or use	instruction and comparative thought (see appendix) ☐ **Note:** Highlighting salient features on multiple symbols on an array *adds* to the complexity of the array; Instead, integrate symbols into the array (without salient feature highlighting) and teach the student to visually recognize, discriminate, and identify the symbols separately using salient feature instruction and comparative thought. ☐ **Choice boards, Calendar systems/sequence boards**: ☐ Expect visual fixation and support shift of gaze to visually attend to and visually locate symbols on linear calendar systems/sequence boards with adaptations to color, complexity, visual fields, distance ☐ Use color windows, occluders, or pointers to model linear localization of symbols on arrays ☐ **Eye gaze boards** (low-tech for partner-assisted scanning) may be appropriate as an accessibility option for students with limited motor access, with individualized visual adaptations to elicit, sustain, or model visual attention ☐ **Eye gaze devices** (high-tech) may be appropriate as an accessibility option for students with limited motor access, with backlit tablet/device to enhance visual	addition of more abstract symbols and sight words ☐ Use **sight word bubbling:** Include bubbled sight words (with bright, saturated colors) in a communication device's array, and gradually remove the bubbling once the student is able to recognize, discriminate, and identify the sight word independently ☐ **Note:** Photos or line drawings are equally as *visually* complex as printed words; however, words are more abstract than photos in symbolic iconicity. ☐ **Selection of symbols:** Select 2-D symbols/icons based on the student's conceptual and visual needs; You may use the *What's the Complexity Framework* (Tietjen, 2019) to determine accessible types of 2-D materials (photos, line drawings, etc.). ☐ **Eye gaze devices:** same considerations as Late Phase II - Concrete Pre-Symbolic, with additional abstract/language considerations such as bubbling of sight words and use of more conceptually abstract symbols

	attention and symbol adaptations to complexity and color ☐ Note: visual/sensory fatigue will impact efficiency and sustainability in using eye gaze devices ☐ **Finished box**: Expect visually guided reach simultaneous to putting symbol in finished box, with appropriate visual adaptations and processing time ☐ **Voice output devices** for requests/comments that can be consistently reinforced ☐ Support (and expect) visual attention to voice output devices prior to modeling or use ☐ **Hand-under-hand** guidance may be useful in the most complex environments or when the student is overstimulated	

Signed languages (tactile ASL, PSE, SEE, etc.) ☐ Same considerations for Early Phase II (above), but expect increased visual attention to signed language (with appropriate individual adaptations to complexity, distance, visual fields, movement, latency, based on CVI Range results) in late Phase II.	**Tactile Input Systems** (Pro-Tactile, haptics, etc.) ☐ Consider the impact of tactile input on multisensory complexity ☐ Tactile input systems may allow the communication partner to provide additional language input without requiring the student to shift gaze from the visual task at hand.

PHASE III: (Approximate score of 7-10 on the CVI Range)

For Emerging Pre-symbolic Communicators: (communicates through behaviors and other pre-symbolic means)	**For Concrete Symbolic Communicators:** (communicates through tangible symbols, photo and/or line drawings)	**For Abstract Symbolic Communicators:** (communicates through abstract symbols and/or words)
☐ **Touch cues and tactile name cues**: ☐ Students in Phase III may still benefit from touch cues and tactile name cues for concrete anticipation and for information during transitions especially when overstimulated or in the most complex/novel environments ☐ Tactile cues should always be paired with a visual referent ☐ Continue to use appropriate wait time and scaffold sensory input as needed to allow the student to process and shift regard/fixation from tactile/auditory to visual information ☐ **Presentation of real objects or object cues in an anticipation calendar:** ☐ Present objects **visually** based on CVI Range results (with regard to color, complexity,	☐ **Touch cues, tactile name cues:** Same considerations as for Emerging Pre-Symbolic ☐ **Tangible symbols on communication system level** (objects, photos, picture symbols mounted on cardboard or plastic) ☐ All symbols are accessed visually, with appropriate Phase III CVI adaptations and separate salient feature instruction with the use of comparative thought ☐ **Considerations for 2-D:** Same as for late Phase II but expect increased salient feature discrimination with appropriate instruction. ☐ **Choice boards, Calendar systems/sequence boards/eye gaze boards (partner-assisted scanning)**: ☐ The student may be able to visually access a larger/more complex array of symbols, but it is important to consider what is appropriate conceptually for the student's expressive communication development	☐ **Voice output devices** (low, medium, high-tech): ☐ Continue to increase number of 2-D symbols in an array with use of spacing and reduced complexity as needed ☐ The student's ability to visually interpret novel symbols on an AAC device will depend on ability to locate and fixate on an intended symbol on a complex array, as well as ability to apply visual discrimination skills using salient features. ☐ Support expanded visual localization/fixation skills (locating symbols on the array in deliberate patterns: circular, diagonal, by quadrants, returning to a point of reference) with visual modeling and/or use of windows, occluders, pointers ☐ Continue to pre-teach and use salient features and comparative thought to recognize novel symbols used on a device

movement, distance, visual fields) ☐ Support student to visually regard **finished box** and utilize visually guided reach when handling symbols ☐ **Hand-under-hand** interaction and constant physical contact may still benefit the student in more complex/novel environments or with more complex/novel materials ☐ Consistently **model conventional gestures** visually with reduced background complexity, and in preferred visual fields; **visual imitation** is possible in Phase III at near ☐ **Voice output devices** for communication partner modeling of the initiation of specific concrete interactions ☐ Elicit (and expect) visual attention to voice output device prior to modeling or use	(e.g., 3 symbols at a time for a sequence board/calendar vs. 6 symbols). ☐ Continue to use color windows, occluders, or pointers to model linear localization of symbols on arrays as needed ☐ **Eye gaze devices** (high-tech): Expect increased skills in locating symbols on the visual array, with appropriate visual supports. In Phase III a student may still have difficulty with complex localization tasks (circular, diagonal, by quadrants, returning to a point of reference) and identifying abstract novel symbols ☐ **Note:** visual/sensory fatigue may continue to impact efficiency and sustainability in using eye gaze devices ☐ **Finished box**: Expect visually guided reach simultaneous to putting symbol in finished box ☐ **Voice output devices** for requests/comments that can be consistently reinforced ☐ Support (and expect) sustained visual attention to voice output devices prior to and during modeling or use ☐ **Hand-under-hand** guidance may be useful in the most complex environments or when the student is overstimulated	☐ **Considerations for 2-D:** Same as late Phase III-Concrete Pre-Symbolic (see column to the left), with addition of more abstract symbols and sight words ☐ Continue to use **sight word bubbling** (see late Phase II-Abstract) with increased number of sight words, and continue to gradually remove the bubbling once the student is able to recognize, discriminate, and identify the sight word independently ☐ **Note:** Photos or line drawings are equally as *visually* complex as printed words; however, words are more abstract than photos in symbolic iconicity. ☐ **Selection of symbols:** Select 2-D symbols/icons based on the student's conceptual and visual needs; You may use the What's the Complexity Framework (Tietjen, 2019) to determine appropriate symbols (photos, line drawings, etc.). ☐ **Eye gaze devices:** same considerations as Phase III - Concrete Pre-Symbolic, with additional abstract/language considerations such as bubbling of sight words and use of more conceptually abstract symbols

Signed languages (tactile ASL, PSE, SEE, etc.) ☐ Signed language may be presented visually ☐ Gain student's visual attention prior to presenting information ☐ Visual language should be presented separately from other visual tasks ☐ Be aware of complexity of background (including clothing of the signer) ☐ Modality switching (between visual/tactile or visual/auditory as appropriate) may be necessary due to visual fatigue or environmental complexity ☐ Monitor pacing during visual presentation, isolation/emphasis of signs with similar handshape, location, etc. for discrimination of details ☐ Direct instruction may be needed for production of signs for new language learners	**Tactile Input Systems** (Pro-Tactile, haptics, etc.) ☐ Consider the impact of tactile input on multisensory complexity ☐ Tactile input systems may allow the communication partner to provide additional language input without requiring the student to shift gaze from the visual task at hand.

V. Appendix: Index of Terms

1. Touch cues

A touch cue is a non-intrusive touch on a specific place on the student's body that is done consistently to convey information about an upcoming event. Touch cues can be used to provide information, give a directive, and give feedback. Touch cues should be paired with sign and/or speech. Communication partners should work together to develop and implement a shared inventory of touch cues for consistent use with the student, but can also be simply used in the moment to alert a child to anticipate additional prompting or physical contact. Touch cues are typically used as a receptive communication mode, but may be used expressively by the student over time to express wants/needs. *Touch cues differ from haptics in that they are not a standardized system but are rather unique to the individual and those who interact with him/her.*

Sample Touch Cue Inventory (this is not an exhaustive list)

Action/Activity	**Touch Cue**
Approaching the child	Light tap/touch to shoulder ***Always use this touch cue before any other physical interaction***
Initiate hand under hand contact	Trail from child's shoulder to forearm before engaging hand-under-hand *(see example to the right)*
Toileting/Changing	Light tap/touch to location of diaper tabs
Putting on/taking off orthotics	Light touch on shin before taking off shoe or putting on
Changing position	Light touch upward under child's elbow
Picking up child	Light touch upward under child's armpits
Putting on/taking off glasses or hearing aids/CI	Light touch on side of head/face
Suctioning	Light touch near trach
Connecting g-tube	Light touch to g-tube site/side of g-tube
Tooth brushing	Show tooth brush tactilely/visually, light touch to side of mouth
Feeding	Light touch near mouth/on lips before presentation of spoon
Sit	Gentle pressure on the shoulder, touch chair

Example

A teacher uses a touch cue to let the student know she is initiating hand-under-hand contact

TIP: Pair all touch cues with simple, consistent verbal and/or signed language (e.g. "Shoes off.")

2. Tactile Name Cues

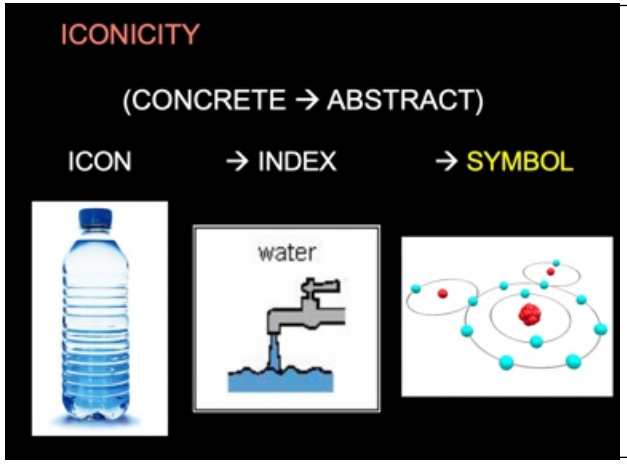
A tactile object or distinct physical touch cue is a technique that someone who is deafblind uses to identify the important people in his/her life. Some examples of commonly used tactile name cues include a distinctive ring, bracelet, or wristwatch. Tactile name cues are concrete tactile cues and are different from name signs, which are abstract signed symbols, shapes or letters. A tactile name cue should be paired with the person's name sign and/or spoken name.

3. Tangible symbols

Tangible symbols are everyday objects that are mounted on cardboard or plastic* and used to label/represent routine activities. Partial objects can be utilized once the child has demonstrated the ability to recognize the symbol and the activity it refers to. Tangible symbols should be created based on the child's understanding of concrete or abstract symbols (appropriate levels of **iconicity**).

Iconicity: The level to which a symbol is concrete (the symbol closely resembles [visually and/or tactilely] the thing it represents [the referent]) or abstract (the symbol does not closely resemble the referent).

TIP: Iconicity is a continuum from most concrete to most abstract.



Iconicity Continuum

An **icon** is a close or direct representation of the referent.

An **index** does not have a direct representation, but can be understood with some specific experience and concepts related to the referent.

An **abstract symbol** bears no resemblance to the referent, and relies entirely on concepts to make the association.

**The purpose of mounting the object on a background is to set it apart as a symbol – this tells the student that the tangible symbol is not the actual object that will be used in the activity, but rather it is a symbol that represents the activity or thing.*

Object cues are objects actually used in routines/activities, which can be presented before the activity to elicit anticipation. For example, the actual toothbrush used in the tooth brushing routine can be used to elicit anticipation of the tooth brushing activity itself.

TIP: Object cues are not mounted and are not considered tangible symbols.

Calendar Boxes
A calendar box system is a sequence of discussion boxes (containers with objects and items that will be used in each respective activity). The communication partner facilitates a calendar conversation by supporting the student to explore and interact with, and label, the objects that will be used in the activity that is about to happen. This should be paired with all other relevant forms of communication, such as speech, sign, tangible symbols, gestures, and/or modeling of devices.

3A. Tangible Symbols - LEVEL 1

For students who do not yet have symbolic representation (the understanding that a tangible or other symbol refers to an activity, object, person, or place).

Anticipation level – 1 symbol presented at a time, highly preferred and/or frequently occurring objects and routines

1. Show symbol
2. Pair with language (sign, speech)
3. Within 30 sec, go to activity / referent
4. Carry symbol to activity
5. Continue to re-introduce and refer to the symbol every 2 min during activity
6. Place in a finished box
7. Repeat!

3B. Tangible Symbols - LEVEL 2

Communication System Level (e.g. choice board, multicell voice output device with tangible symbols, linear calendar system) for students who have some level of symbolic representation (including emerging symbolic representation).

These symbols should be available to the child to use for communicative intent throughout the day.

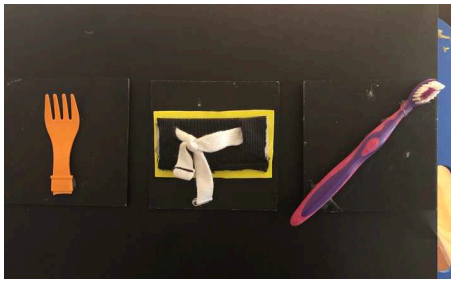
STACS symbols (APH) used on a choice board and a 1-cell voice output switch.

CVI Sequence Board (Phase II)
Image used courtesy of Rachel Bennet:
https://www.pathstoliteracy.org/strategies/sequence

An occluder/window used to direct a student's visual attention to a symbol.

Video example – Calendar Conversation (Chris Montgomery):
https://www.youtube.com/watch?v=foN-gLb27jY

Calendar Systems (Daily Calendar)
A Daily Calendar is a schedule of the student's day made up of tangible symbols and/or object cues, used to preview and review the student's day. This can be paired with a calendar box system. It should be considered whether the student is ready for a partial, half, or full day calendar system. Calendar systems should be considered opportunities for choice-making and interactive conversation about the events of the day, not as a rote experience of "going through the sequence of events."



Calendar System (3 activities)
Image used courtesy of Rachel Bennett

Beginning calendar system (3 activities)

Advanced calendar system (a full day)

4. Conventional gestures

Conventional gestures are pre-linguistic movements we make that are part of a learned, shared system and have a meaning that is understood within a society or culture. Examples include: waving hello/goodbye, shaking hands, fist bump, push away, pull towards, pointing, hands in front with palms up for request, nodding/shaking head yes/no.

5. Voice output devices

Voice output devices are for initiating specific interactions for concrete communicators.

- The message used on a voice output device needs to be directly and consistently paired with the referent – for example, requesting attention, saying "Hi" to a communication partner.
- Use vocabulary that can be immediately reinforced by a concrete object or action.
- Students may access more complex arrays using motor memory (consistent location). Visual considerations appropriate for the student's CVI Range should still be applied. For example, a student who is in early Phase II may use a 12 cell AAC device using primarily motor memory. It would be helpful to reduce the visual complexity and use CVI adaptations to color and spacing and possibly a tactile keyguard, in order to maximize access but also to promote visual goals and reduce fatigue/overstimulation.

6. Salient Feature Instruction and Comparative Language/Thought

Salient features are the unique visual components of any 3-D or 2-D object or target. They are "the defining elements that distinguish one target from another," and are used to "facilitate the recognition of an image, object, environment, or person." (Roman-Lantzy, 2018). Salient feature instruction is an approach used with individuals with CVI to learn to recognize and identify novel targets based on their defining features, which can be highlighted and emphasized during direct instruction with adaptations such as outlining with a preferred color. "Comparative language is the use of specific language that helps indicate or teach the similarities and differences in two or more targets" (Roman-Lantzy, 2018). The use of comparative language is critical to the development of comparative thought and the ability to distinguish objects based on their salient features.

7. Sight Word Bubbling (Roman, 2019)

Sight word bubbling is a technique used for teaching visual discrimination/recognition/identification of sight words in literacy instruction for students with CVI. Appropriate instruction with sight word bubbling involves salient feature scripts and the use of comparative language to systematically teach the student to recognize the unique visual features of sight words.

8. Hand-Under-Hand

Hand-under-hand is a technique in which the communication partner places his/her hands under those of the learner. This allows-the child to explore and participate in tactile experiences at their own comfort level. In hand-under-hand interactions, the child has control over the movement of his/her hands and can withdraw whenever needed. This promotes self-determination and increased independence, whereas hand-over-hand manipulation is restrictive and does not allow the child to control the interaction and movement, or to demonstrate his/her own abilities.

9. Shared forms of communication

"Children who are deaf-blind and express themselves at the pre-symbolic to early symbolic levels of communication require responsive adults who are able to recognize their communicative attempts and converse in a range of communication forms. including concrete forms like body language. Conversation at this or any level necessitates access to the communication partner's expressive form and a sharing of mutual forms of communication." (Bruce, 2003, p. 106)

For students who communicate pre-symbolically, unconventionally, and/or use AAC, it is important that communication partners, including adults and peers, utilize parallel or matching communication systems and modes as the student uses. For example, a child who communicates using sign language should have access to adults and peers who communicate with fluency in sign language. A child who communicates with a multi-cell AAC device should also have access to observing peers and adults communicating with that modality on a formal language level.

TIP: Students with sensory deficits require individualized adaptations to ensure sensory access to observing shared forms/modes of communication.

10. Constant physical contact

Constant physical contact refers to a technique commonly used to support communication access for individuals who are deaf-blind, in which a communication partner remains in tactile proximity/contact in a non-intrusive manner. For example, a communication partner may sit with their knee touching the student's knee to let him/her know "I'm still here." Constant physical contact can also provide a cue to the student that an active communication partner is present.

11. Total Communication

Total communication is the inclusion of multiple modalities for presenting information to the student to increase opportunities for a message to be received and interpreted. It also allows the student the opportunity to use one or more modalities to convey a message back based on their strengths, access, and understanding. Total communication does not necessarily mean simultaneous communication. Scaffolding or sandwiching of information presented in multiple modalities reduces the complexity of the sensory environment and allows for processing of information in each modality.

VI. Additional Resources

Vision, Language, Learning, Communication Framework (Roman & Blackstone, 2019)
Vision, Language, Learning, Communication (VLLC) is a framework for developing appropriate AAC programs for children with CVI, created by Dr. Christine Roman and Dr. Sarah Blackstone (2019). The overarching considerations of the VLLC framework should be utilized for all students with CVI. As described above, the AAC-CVI Matrix (Russell & Willis, 2020) provides specific guidelines for scaffolding expressive communication development, balancing results from the Communication Matrix (Rowland, 1996; Rev. 2004) with results from the CVI Range (Roman, 2007; Rev. 2018). This should be seen as complementary to the VLLC framework. Refer to the "Sample Scripts" discussed above, which can be found in *Cortical Visual Impairment: Advanced Principles.*

Perkins eLearning webinar, "Vision Language Learning Communication: An Approach to AAC for Students with CVI" (Roman & Blackstone, 2019): https://www.perkinselearning.org/videos/webinar/vision-language-learning-communication-approach-aac-students-cvi

Roman-Lantzy, C., & Blackstone, S. (2019). Children with CVI and complex communication needs, In *Cortical visual impairment: Advanced principles (Roman, Ed.)*. APH Press, American Printing House for the Blind.

Salient Features and Comparative Thought

- Roman, C. (2018) Cortical visual impairment: An approach to assessment and intervention (2nd Ed.). New York, NY: AFB Press.
- Salient Features & Comparative Thought (PCVIS): https://pcvis.vision/educators-and-therapists/salient-features-and-comparative-thought/
- Roman on CVI – Digging Deeper: Comparative Thought (Roman, 2019): https://www.youtube.com/watch?time_continue=7&v=cKm9xUTeD1g&feature=emb_logo
- Salient Features Collaborative: https://cvicollaborative.wixsite.com/salientfeatures

Sight Word Bubbling

- Examples of this technique and detailed explanations are provided in *Cortical Visual Impairment: Advanced Principles* (Ed., Roman, 2019).
- A free online application for creating sight word bubbling is available here: http://roman-word-bubbling.appspot.com/
- Additional examples of sight word bubbling and literacy instructional approaches for students with CVI are available via PCVIS, here: https://pcvis.vision/educators-and-therapists/cvi-and-literacy/

Pediatric Cortical Visual Impairment Society (PCVIS) http://pcvis.vision

Communication Matrix www.communicationmatrix.org

- Communication Matrix Training- A 3-part webinar series presented by Kathee Scoggin
  - Part 1: https://www.youtube.com/watch?v=EuufdwrD4wg&t=2128s
  - Part 2: https://www.youtube.com/watch?v=WYWpHGzZyVk
  - Part 3: https://www.youtube.com/watch?v=NblRn-Q7sIQ
- Understanding and Nurturing the Communicative Competence of Learners with Significant Disabilities – A 2-part webinar series presented by Philip Schweigert (for Montana Deaf-Blind Project): http://mtdeafblind.ruralinstitute.umt.edu/events-training/

The Bridge School

- Examples of communication/AAC and CVI interventions
  - Communication Module: http://communication.bridgeschool.org/intervention/
  - CVI Module: http://cvi.bridgeschool.org/interventions/

Open Hands, Open Access: Deaf-Blind Intervener Modules (OHOA)

- Free online learning modules covering extensive content on deaf-blindness, communication development, sensory systems, and educator/intervener strategies: http://moodle.nationaldb.org/

National Center on Deaf-Blindness (NCDB) https://www.nationaldb.org/

- Find your state Deaf-Blind Project: https://www.nationaldb.org/state-deaf-blind-projects/

Connections Beyond Sight and Sound – Maryland/DC Deaf-Blind Project http://marylanddb.org

New York Deaf-Blind Collaborative http://nydeafblind.org/

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